

IBM DATA BASE/DATA
COMMUNICATION STRATEGIES
FOR THE 1980s



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I BACKGROUND AND ISSUES

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A. BACKGROUND

I. DATA MODELS AND STANDARDS

- As soon as data base management systems (DBMS) started to emerge as a popular concept, several things occurred:
 - CODASYL formed a Data Base Task Group (DBTG) both to determine what this strange beast was and to prevent some of the standards conflicts that always arise in implementation.
 - Both GUIDE and SHARE formed their own DBTG.
 - The conflict began over whether standards should be developed and, if so, what they should be.
- Much of this controversy revolves around data models, of which three are of major importance: hierarchical, network, and relational. They are important for understanding what IBM has done concerning DBMS, and what it may do in the future.

- The hierarchical model is actually a special case of the network model. It has the advantage of facilitating implementation of applications from a programmer's point of view.
 - The network model was developed with the more sophisticated user in mind - one who understands the importance of the data base administrator. It has the advantage of providing many tools to permit the optimization of the data base structure and operation. The result is a more efficient system.
 - The relational model was developed with the end user in mind. The result is an easy-to-use ("friendly") system.
 - There has also been considerable speculation about a coexistence model that would accommodate the best of all three of the above.
- Essentially, early standards efforts focused on the network model because IDS used that model. However, IBM decided to concentrate on the hierarchical model with IMS. The relational model was left up to the academic types (both internal and external to IBM).
 - To this day, there is controversy not only about which model is best and which should be a standard, but about the technical aspects of the models themselves. This technical competition among vendors and within standards organizations is not new - one has only to think about COBOL, ASCII, and SDLC. However, the potential for creating systems monstrosities has never been so great as with DBMS.

2. INITIAL IBM DBMS SYSTEM

- There were many internal IBM DBMS systems that never became available to IBM customers as products. The three components that did become available all started as independent efforts without plans for eventual integration, specifically, IMS, CICS, and GIS.

- These major IBM systems have been around for over ten years and have been integrated using a variety of interfaces, tools, and add-ons that were never contemplated when the systems were designed.
 - GIS can trace genealogy back through the formatted file system to early government command and control systems.
 - IMS, on the other hand, is a relative "Johnny-come-lately" - having been started in North American Aviation Space Division as part of the Apollo moon-landing program.
- Individual IBM customers have spent millions of dollars converting to IMS, and others have plans to do so. Unfortunately, there has been dissatisfaction with the results achieved by many users, as well as continuing rumors concerning a new relational system (System R). However, years have slipped past without any significant announcement from IBM in the data base area (except for System/38 which is aimed at end users).

B. ISSUES

- The purpose of this report is to assess:
 - What IBM would like to do in the data base/data communication (DB/DC) area.
 - The pressures that may impact IBM's plan.
 - The impact of IBM's strategy on the marketplace.

II SIGNIFICANCE OF IBM'S DB/DC STRATEGY

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A. CURRENT STATUS

- The concept of host computers driving large centralized data bases has been at the heart of IBM'S DB/DC strategy. Regardless of the DBMS employed, large data bases require large centralized computer systems for both processing power and storage requirements. IBM's Systems Network Architecture (SNA) supports this strategy, and it has been quite successful in the past. However, there are indications of trouble.
 - IMS has been so successful in burning CPU cycles that even the recently announced IBM 3081 Processor Complex will have difficulty providing satisfactory performance levels in many environments.
 - Some of the data bases being developed are literally becoming unmanageable (for example, data bases that cannot be reorganized on any reasonable timeframe).
 - There is increasing apprehension on the part of many companies to put all these eggs in one basket for reasons of security.
 - Many companies that went to considerable expense to centralize are now beginning to decentralize because of end user dissatisfaction with their central service organizations.

- Cheap, responsive alternatives are becoming increasingly available from vendors - both hardware and computer services - which are marketing directly to end users.
- While aware of these tendencies among its client base, IBM is caught in a rather difficult situation with regard to its DB/DC strategy for the following reasons:
 - IMS has been successful in selling hardware.
 - Corporate management in IBM does not want to become committed to development and maintenance of a totally new DB/DC system because of past difficulties and expense associated with such systems.
 - IMS will not go away even if such a commitment were made. Too many IBM customers have invested too much money in IMS.
 - Conventional attempts to "bridge" between IMS and relational systems (such as the much rumored System R) have demonstrated performance characteristics that are unacceptable even to those accustomed to IMS.
- Therefore, IBM has developed larger and larger processors in an effort to solve the DB/DC problem. This has the advantage of being a classic strategy with which IBM feels quite comfortable, and the game will be played as conservatively as possible.
- The announcement of the IBM 3081 is a good example of this conservative approach.
 - The announcement contained no significant relief for DB/DC users other than raw processing power at the host.
 - The potential for architectural distribution of data base functions was not promised or addressed in the technical documentation.

- The long-anticipated relational DBMS was not in evidence.
- However, a few weeks before the H-Series announcement there were several news items of importance for future developments.
 - An IBM employee was quoted as saying a bridge between IMS and a relational system was "impossible."
 - One week later, IBM officially denied the quotation, stating that while "...the problem of supporting both hierarchic applications and relational applications on shared data is hard...it is still being worked on."
 - Software AG announced a data base machine (DBM) that can off-load IBM mainframes using Adabas (an inverted file DBMS having "relational characteristics").
 - Later, IBM announced a new release of IMS that allows multiple sharing of data bases and communications sharing with other VTAM-based systems. This could be the first step toward building the bridge to a relational DBMS.
- INPUT concludes from these events that:
 - IBM probably has a workable bridge between hierarchical and relational data models for most applications. In fact, it may be a complete bridge that IBM just does not want to announce.
 - If Software AG has been able to develop a backend DBM, IBM most certainly has the capability of doing so.
- While this report was being prepared a "breakthrough" in DBMS performance was announced by Comshare Inc.

- The system that will be called Commander 4 is based on extended set theory. Comshare has reportedly developed two prototype systems to test feasibility.
 - They are satisfied that set theoretic systems will "...not only boost performance to unprecedented levels, but can be used with virtually any data model including a Codasyl product."
 - The only other company working on theoretic architecture is Set Theoretic Information Systems Corporation (STIS).
 - Evidently the idea has been around for over 10 years, but has had practically no impact. The system would be implemented on a "highly intelligent backend" (HIBE) that would cost \$1.2 million to build.
 - One of the problems with theoretic products is that the underlying theory is difficult to understand. For example, Ted Codd, who has pioneered IBM's work in relational systems, has reportedly remarked that the published papers are "obscure."
 - Comshare finally sent one of its senior research staff members to study the underlying theory for a year and a half. The company is now convinced that David A. Childs (STIS's president) really has the answer to DBMS performance problems.
 - The performance of the working prototypes is reported to be "four times as fast as relational."
- INPUT does not anticipate that IBM will announce such a system in the foreseeable future, since it has put so much work into relational systems. However, it is probable that new theories and architectures will eventually replace current thinking and implementation. Certainly there is plenty of room for improvement in current IBM systems, and somewhere within IBM someone other than Codd is unquestionably studying theoretic systems.

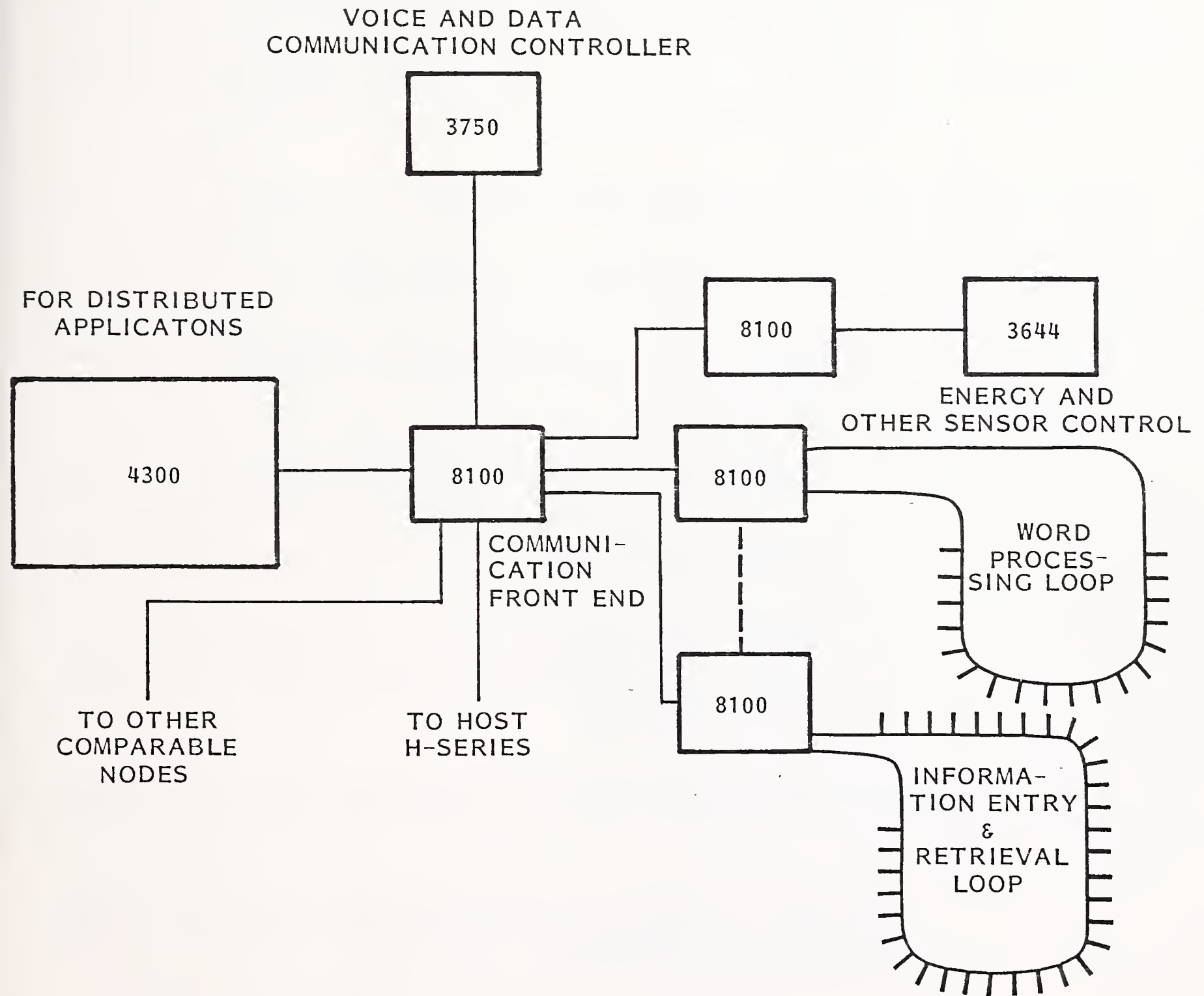
B. WHAT IBM WANTS TO DO

- The main thing IBM wants to do is control the impact of any new system hardware or software - on revenue. Once this is understood, it becomes easier to project what it wants to do in the DB/DC area.
- IBM has been successful in selling IMS despite severe performance problems. As customers continue with plans to convert applications to IMS, there is significant potential for additional hardware sales of large-scale mainframes and storage. Lower costs for central processors will entice more and more customers in this direction - even those climbing the 4300 series ladder.
- The longer a new DBMS announcement can be delayed, the more customers will be confronted with hybrid systems once something new is announced. Regardless of the way the bridge is constructed, it will be costly. The preferred strategy would be as follows:
 - Announce (or deliver) a new DBMS only after maximum hardware purchases have been made of current mainframes, and IMS is being used by most potential customers.
 - Once announced (with a bridge), encourage using the new DBMS for new applications. It will be easy to use, but performance will probably suffer, especially in an environment where IMS applications are sharing the same data.
 - The performance characteristics could be even worse if it is decided to support network data models under the same umbrella.
- As long as the hybrid systems can be supported by larger mainframes, IBM would prefer to ignore off-loading the large hosts with either backend DBMs, or through distributed data base support (both of which have a lot in common).

- However, relational DBMSs have great potential for distributed processing because of their "user-friendly" interface. It is probable that IBM will encourage the use of such systems at distributed nodes within the network. This has several advantages:
 - It will be easier for users to develop new applications - a real plus.
 - The nodes will continue to depend on data from the host, but will also be subject to growth, which will practically force them to IBM's main product line (rather than to minicomputers or GSD products such as system 38, which has relational capability).
 - In other words, anticipate distributed nodes that will look like those in Exhibit II-1.
- As mentioned previously, IBM will be conservative in its approach to DB/DC. It is probable that both backend and distributed DBMs are not scheduled to appear until the mid-1980s. INPUT continues to feel that there will be pressure from external sources, which may force an earlier announcement. The Software AG announcement is only one example.
- However, IBM would like to do the following:
 - Delay the announcement of a relational DBMS until after 3081s start to be delivered in fourth quarter 1981.
 - Make it available on 4300s and 308Xs only. This would effectively kill the 3033, which is the last survivor of the 303X series.
 - Ignore any problems of compatibility with GSD system, including System 38.
 - Proceed slowly toward distributed data base systems using 4300s, or smaller versions of 308Xs at the nodes.

EXHIBIT II-1

A FUTURE DISTRIBUTED PROCESSING MODEL



- Begin to encourage the maintenance of backup data bases at central hosts for security purposes. This will be based upon the availability of "cheap" communications to the host and will be something of a departure from IBM's traditional opposition to duplicate data bases.
- By 1984-1985, IBM should be in a position to start growing the nodes into ever larger installations as data procesing and office automation begin to become integrated. Host systems would serve primarily as control centers providing:
 - Central dictionaries and directories.
 - Backup facilities for operating data bases.
 - High-security depositories for sensitive corporate and personal information.
 - Responsibility for continuing responsiveness to multiple (and incompatible) data base systems that will exist both within and outside of the enterprise.
 - Primary control point for internal networks and for inter-connection with all external networks in order to monitor data and information flow.
- This scenario represents the best of all possible worlds from IBM's point of view.
- Data bases at central hosts will continue to grow, requiring ever larger processors and storage devices.

- This will result from providing services to smaller systems at the network nodes, which are also positioned to grow to large systems in response to the enormous data and information requirements as offices become automated.
- The advantages to IBM of such a strategy are clear. There will be double, triple, and even quadruple duplication of data, information, hardware, and software. In addition, the DB/DC systems to support such a distributed data base would defy duplication by any competitor.
- The danger to IBM is that the very complexity of the DB/DC system will cause it to eventually fall of its own weight before it can be effectively implemented. This would come about primarily because neither the data base systems, nor the communications systems, nor the operating systems were designed to function efficiently in such an environment. Also, progress is being made by competitors who have had an opportunity to start with better architectures. This could force drastic changes in IBM's strategy, resulting in speed-up, at least, of the announcement schedules.
- In other words, it is doubtful that IBM will develop a true coexistence model. The plan will be to develop complex bridge systems to integrate existing DBMSs.

III TECHNICAL AND COMPETITIVE IMPACTS ON IBM'S STRATEGY

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A. THE THREAT FROM THE BOTTOM

- IBM's DB/DC strategy is the product of the Data Processing Division (DPD), which is accustomed to dealing with data processing people, not end users. The success of the strategy depends upon slowly pushing computer and access to information to end users. The ability of designers, accustomed to supporting large systems used by programmers, to successfully implement "user-friendly" systems has to be suspect.
 - The primary design point of the great grandfather of MVS (OS/360) was ease of use. The result was a system so complex that JCL is even worse to deal with than most programming languages.
 - Query-By-Example (QBE), a nonprocedural language for use with relational systems, was developed by IBM's research facility in Yorktown Heights, where most of the employees have never been exposed to commercial applications.
 - SQL (Sequel) was developed for use with System R in what amounted to an academic environment in San Jose.

- Both of the above languages have been tested primarily with systems people and not with regular office workers.
- In addition, there is always a tendency among systems designers to keep adding functions (and accompanying complexity).
- It is probable that designers of minicomputers, small business systems, and word processing systems will design systems that appear more friendly to end users. (This includes IBM's GSD and OPD, along with the outside competitors.)
- In addition, the probability of dedicated systems for local data bases will create not only performance imbalance (extreme slowing of transactions requiring host processing), but will expose the inefficiencies associated with centralized data bases. The tendency will be to distribute data bases to end users rapidly rather than on an IBM-controlled basis. Generally speaking, these local data bases will represent the operational data of the local establishment.
- A logical extension of local data bases with fast response time is the personal data base, where an individual has complete control over the entire data base.
 - The individual may be an engineer, professional person, or executive. However, the thing which characterizes these persons is that most of the processing power and storage needed can be encompassed within a personal computer.
 - It is INPUT's opinion that a high percentage of white collar workers could benefit from the use of a "friendly" personal computer - whether for entry or retrieval of messages or reports, or for problem solving (computation). A personal computer represents only a modest investment when considering today's personnel costs. The effect of all this is the off-loading of the large central mainframe in favor of a more responsive personal system.

B. DATA BASE MACHINES

- The concept of building ever larger, general-purpose processors must eventually end. Processors are becoming so cheap that they can be dedicated to an individual (such as the personal computers mentioned previously) or to specific computing functions. This has given rise to the concept of DBMs.
- Conceptually, DBMs fall into at least three categories:
 - Backend systems for off-loading large central hosts.
 - At nodes in a network for general-purpose computing, as a standalone, or connected into the network.
 - Smart peripherals that can range from simple intelligent controllers up through controllers that function as a data base processor.
- It would appear that IBM has elected to go with the intelligent controller approach. The 3380, which was announced with the 4300 series, has capabilities that have not yet been applied to software support. The channels announced with the 3081 will provide sufficient capacity to handle the anticipated data flow from the nodes.
- This approach is clearly at the low end of the DBM spectrum, but from IBM's point of view, it has the advantage of permitting controlled improvement in DBM performance.
 - Originally, some access method functions could be distributed; e.g., arm positioning, record content searches, and error detection and correction.
 - This migration of function from the mainframe to the controller could result in significant performance improvement for the DBMS, and it

also could make life somewhat miserable for the plug compatible mainframe manufacturers.

- This evolutionary approach on IBM's part could be disrupted by rapid development in other areas.
 - The possibility of a "super smart" intelligent controller incorporating current technology and new architecture is represented by the University of Toronto's Relational Associative Processor (RAP). This DBM caused considerable interest while still in the prototype stage. RAP improves performance for relational data base functions through improved rotational storage (intelligent head-per-track storage) and electronic memories implemented in Charge Coupled Devices (CCDs) and/or Bubble Memory. Thus true parallel processing eliminates indices and all the problems associated with retrieval of information and maintenance of the data base.
 - The application of specialized DBMS on minicomputers in specific environments can also lead to tremendous improvements in system performance. The burden of conventional operating systems' overhead in the nodal configurations depicted in Exhibit II-1 cannot be over-emphasized. The announcement of MVS support for the 4341 may make it a "bridge machine," but it cannot possibly compete against a dedicated minicomputer for DBMS applications.
 - DBMs deployed in a network operate as loosely coupled processors and function as co-equals, rather than as slaves to a host (as in SNA). Many analysts thought the IBM 8100 could function in such a manner using the DPPX operating system. However, problems of programming and processor speed, and mass storage limitations effectively ruled it out.
 - Network Node Data Management Machines (NNDMM), as presented in technical publications, cause several communications problems (such as propagation delay) that should be

alleviated by satellite communications and improved query languages early in the 1980s.

- The backend DB processor to a large host has been discussed for many years. Fundamentally, the purpose of the backend DBM is to reduce mainframe load, improve DBMS performance, and improve security on the network. Once again, the economies are achieved by specialization (simplification) of function, and a "close" coupling to the host.
 - At this time it is possible to speculate on the role of the "dyadic" processors within the 3081. It is certainly plausible that one could be used as a DB engine in certain configurations. This would represent a "tight" coupling of general purpose computer and DBM. However, the concept of the backend "closely" coupled system has been around for some time and is also a revenue producer. The Adabas backend costs approximately \$400,000.
 - It is probable that, if IBM feels challenged, it would prefer to improve performance at additional cost with the closely coupled backend.
- All the DBM technology mentioned above is certainly within the scope of IBM's capability. IBM research was exploring associative memories over 15 years ago. It is probable that IBM can move in any direction based on any specific competitive threat. However, a casual threat does little to prompt IBM - witness the 3705, which has been a candidate for replacement from the day of announcement.
- The probable impact of DBMs is in the standalone and network configurations, where tremendous performance differences can be isolated. The threat of a backend computer can probably be contained with the application of IBM intelligent controllers.

C. THE THREAT FROM WITHIN

- The current internal conflict between DPD and GBG (General Business Group) within IBM continues despite IBM's policy statement. A competitive environment is still encouraged, and GSD came out with the first IBM relational "DBM" in the System/38.
- It is INPUT's opinion that DPD is not especially concerned with compatibility, except within its domain. Therefore, compatibility between 4300 series nodal systems with host 303X series and 308X series will be stressed, rather than use of the System/38.
- The threat to DPD is that System/38 will become a major success (despite late shipment). If this occurs, early announcement of a relational DBMS for DPD systems could be forced. However, corporate IBM may decide to remain on schedule, depending on the specific financial implications.

D. THE THREAT FROM WITHOUT

- Much has been written about the Bell Systems' Advanced Communication Service (ACS), both its potential and its problems. With the FCC ruling in the Second Computer Inquiry, it is probable that many new and advanced services will be forthcoming from common carriers, value-added networks (VANs) and computer services companies. None of these is more significant than ACS, because of Bell System resources in technology, capital, geographic coverage, and maintenance facilities.
 - The many services promised by ACS include some that border on DBMS. For example:

- Does store and forward become a data base system by including computational capabilities and selective retrieval capabilities?
 - When does on-site communications hardware become competitive with both general-purpose computer systems and DBMs?
- These questions are open to speculation at the present time. The current mood in the FCC is toward deregulation, and the Reagan administration will certainly not attempt to reverse this trend.
- Only recently, the restriction of requiring a separate organizational entity for marketing "enhanced services" was removed from GTE. Since GTE has already acquired Telenet, its capabilities for expanding into the data base area are excellent.
- Tymshare, which has already formed TYMNET as a VAN, is very interested in providing data base services using three data base systems: EXPRESS, FOCUS, and MAGNUM. With the FCC ruling, direct marketing of combined computer/communications services will unquestionably begin.
- Those computer services companies that have not spun off separate organizations for communications services will now feel free to provide network services without fear of regulation.
- In addition to the merging of computer services with communications services provided by common carriers and VANs, on-line data base services could have a significant impact on IBM's strategy.
- INPUT has forecast that on-line data base services will grow from \$1.2 billion in 1979 to \$4.3 billion in 1985.

- Significantly, most of these proprietary data bases do not use IMS-type DBMS, but rely on systems such as STAIRS (Structured Access Information Retrieval System).
- The hardware and software to support a \$4.3 billion business cannot be ignored by IBM: it must provide easy-to-use and efficient data base systems. The users of proprietary DBMS are normally not systems people, and transaction billing precludes heavily burdened systems such as IMS from being competitive in this marketplace.
- As office automation evolves toward the "office of the future," the need to integrate image processing with DBMS becomes critical. Current IBM DBMS systems were not designed to support such integration.
 - Once again it is a question of merging technologies and information management versus data management. Numerous vendors are considering "electronic file cabinets" for the office so that documents can be retrieved. The extension of current DBMS to include images may occur quite rapidly.
- The rapid development of word and text processing systems may also prompt change in current data management concepts. When it becomes cheaper to store images of documents (reports, correspondence, graphics, etc.) on electronic media rather than on paper, the concepts of retrieval and manipulation of individual data elements will change drastically.
 - Multifunction office equipment will be able to produce and store meaningful information in image form more economically than a large, centralized host computer with its tremendous systems software overhead.

- Numerous current vendors are aware of these opportunities, and numerous others are becoming sensitive to the potential market. Getting technology into the office environment requires changing current thinking about information retrieval.
- In summary, the expense of the overhead associated with current IBM DBMSs will be exposed once billing for network services becomes transaction-oriented. IBM recently released the following numbers when refuting the statement that it was impossible to bridge IMS to a relational system:
 - The airline control program (ACP), which was hand-tailored for rapid response, can achieve rates of up to 180 transactions per second.
 - The rate with hierarchical models is between 20 and 50 transactions per second.
 - The rate with a relational model (System R) is between 3 and 20 transactions per second.
- Presumably, the hardware configurations were comparable. It was specifically stated that all were tested on 5M-byte hardware. The following conclusions can be reached:
 - The burden of standard IBM operating systems and IMS causes a system to operate at approximately 11% to 28% of a hand-tailored system.
 - If System R is used, the transaction rate is between 1.6% and 11% of a custom system.
- In other words, if current IBM DBMS support (IMS) is used, it requires 3.5 to 9 times as much processing power as a dedicated system. For a "user-friendly" system such as System R, it will require 9 to 62.5 times as much processing power.

- The problem is probably worse than the above ratios indicate because, if multiple systems are required to access the same data base, contention among systems would impact performance (as evidenced by MP systems with only two processors).
- It would certainly appear that IBM must start thinking about the problems associated with large centralized data bases. There are only two alternatives:
 - Replace not only the DBMS, but the operating systems as well.
 - Off-load the large mainframes by employing both backend and distributed DBMs.
- INPUT does not feel that IBM is going to replace MVS or IMS. Therefore, it must eventually distribute processing power and data bases both geographically and architecturally.
- IBM sincerely wants to make its data base strategy work. For example, IBM's largest internal system is the Advanced Administrative System (AAS). This system was implemented in the 1960s on a custom basis using BDAM. The system needs to be replaced, and there is some sentiment for using IMS, since that is what IBM is urging customers to do. The problems are comparable to those of converting the ACP to a generalized DBMS, and the IMS-oriented AAS probably never would be a viable replacement.

IV PREDICTING WHAT IBM WILL DO

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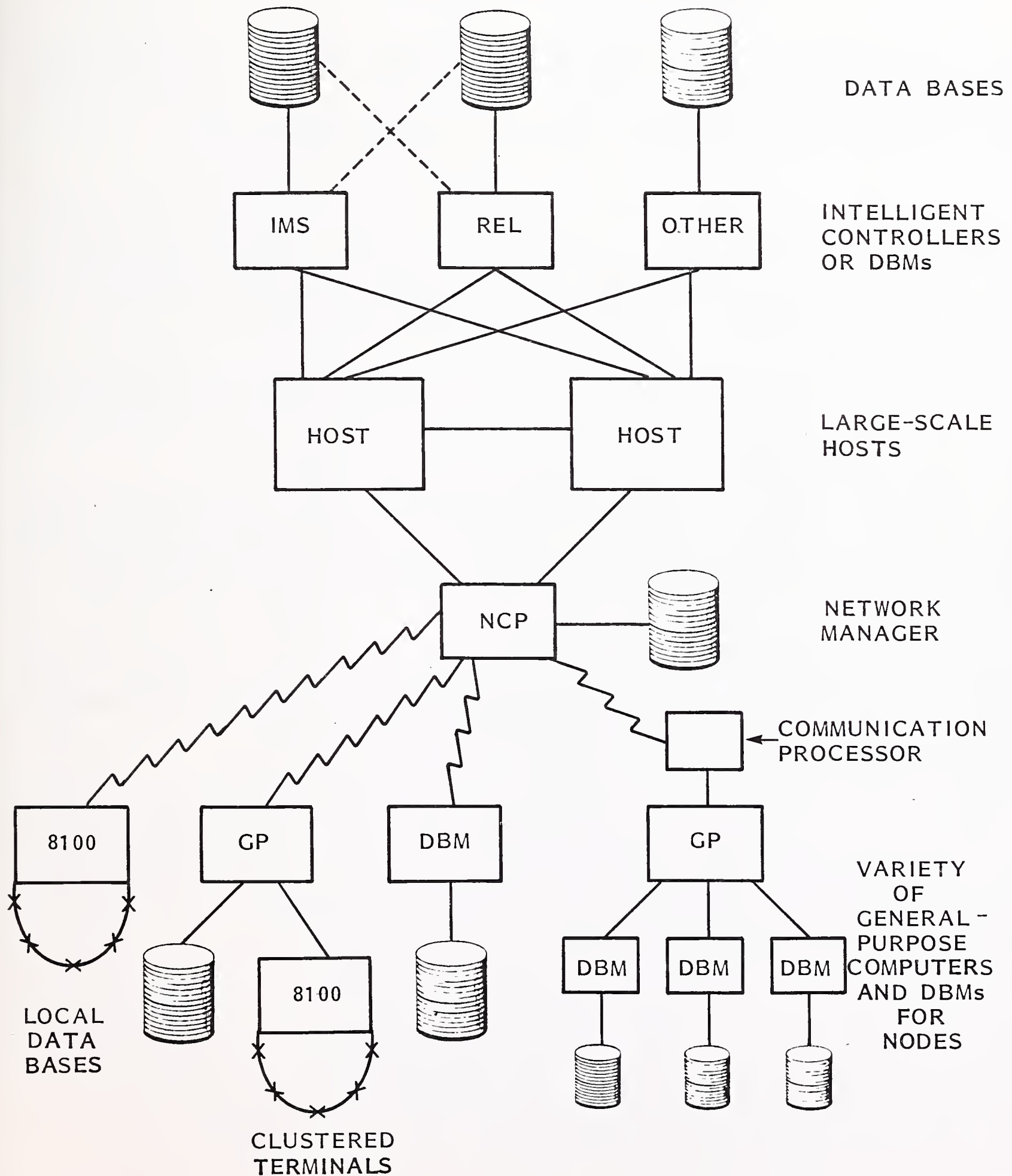
A. EVOLUTION OR REVOLUTION

- INPUT has already determined that IBM would prefer to be conservative in its DBMS approach. Considering the performance problems cited above, this is understandable, and the approach may be best for customers.
- However, customers requiring very large data bases with high transaction rates may be in for some unpleasant surprises, even with the additional processing power associated with the 3081.
- IBM has always been responsive to large customers. As these problems start to surface, there will be internal pressure to expedite schedules on both delivery and announcements.
- Therefore, IBM may be forced to change its plan, just as it did with the announcement of the 3033. However, the architecture of the 3081 and its channels, along with the 3880 controller, gives IBM flexibility that was unavailable in previous systems. Announcements of both hardware and software will be phased in under rigid control, which will continue to confound competitors, customers, and consultants.

B. THE ARCHITECTURE OF FUTURE DB/DC NETWORKS

- Exhibit II-1 depicted a potential node using current IBM equipment. It is basically a DPD-oriented node.
 - The 8100 could theoretically be replaced with products from either competitors or GSD and/or OPD.
 - The 4300 could be replaced with a System 38 in certain environments, or it could grow into a 30XX system; but functionally the node would remain the same.
- When DBMs become available, the overall network will have substantially more architectural flexibility, as shown in Exhibit IV-1.
 - The potential of this type of network will be determined by software, not hardware. An 8100 is included in this network, but it will not play a significant role in a distributed DBMS for the following reasons:
 - The 8100 shown will be operating in DPCX mode (essentially as a cluster controller) because this will be encouraged by IBM. If users want to design and implement their own networks using DPPX, they will not receive much assistance from IBM. This "roll your own" attitude is not designed to promote deviations from SNA.
 - The disk storage capacity of the 8100 precludes its use as the primary system in most large-company environments. As office automation develops, this limitation will be even more pronounced.
 - The systems software support is not in the "mainstream" of IBM's plan for growth at the distributed nodes.

EXHIBIT IV-1
POTENTIAL NETWORK ARCHITECTURE



- . The 8100 is not designed to be a DBM, and it will not be supported for distributed data base except in what amounts to 3790.
 - . INPUT believes that the 8100 will function under a larger system, whether that system is a remote host or a local distributed processor, as shown in Exhibit IV-1.
- It is clear that IBM must support computer-to-computer communication between hosts and distributed processors. However, the question is whether IBM will support both general-purpose systems (4300 series and 308X series) and DBMs for distributed data bases.
 - INPUT believes that IBM will eventually support both, and that the primary DBMS at these nodes will be relational.
 - The connection of a DBM directly to the network (as opposed to using it as a backend) will support all data models (hierarchical, network, and relational) depending upon the particular requirements of the node.
 - The DBMs will be dedicated to particular data models, and their performance will be significantly better than the general-purpose systems (when running a DBMS).
 - The host can also communicate with a complex distributed node, which includes its own communications processor and multiple backend DBMs. In fact, it is possible that some distributed nodes could outgrow their host systems in terms of processing power.
- . In this case, a large node could literally serve as backup for the host for network management purposes.

- Indeed, a network could be designed to provide for a backup system that could take over all the functions of the host - including a copy of all host data bases.
- The "network manager" shown in Exhibit IV-1 should not be confused with the long-suffering concept of a network control program (NCP), which has been established under SNA. A true network management facility would be devoted to monitoring and controlling the network.
 - This would include not only traditional communications services such as logging performance, error correction, and rerouting, but also store-and-forward message services and directories for the network. Directories are used to identify people, organizations, physical locations, and terminals.
 - In many ways, the network manager would perform many of the functions promised by ACS. The decision to provide for such functions in a private network, or to purchase the service from a common carrier, will depend upon implementation and the individual company's requirements.
 - Host systems will share responsibility for data dictionaries with the distributed systems, but once again the network management function includes the ability to seek out specific items of data and information within the network.
 - It is probable that IBM will continue to maintain both directories and dictionaries on large general-purpose systems, even after they replace the 3705. However, there is no reason that the communications processors cannot perform those functions.
- It is also probable that IBM will use intelligent controllers for initial steps into backend data base machines. Sitting behind the host - but also interfacing as a distributed node - the network depicted in Exhibit IV-1 illustrates both

geographic and architectural distributed data processing and distributed data base.

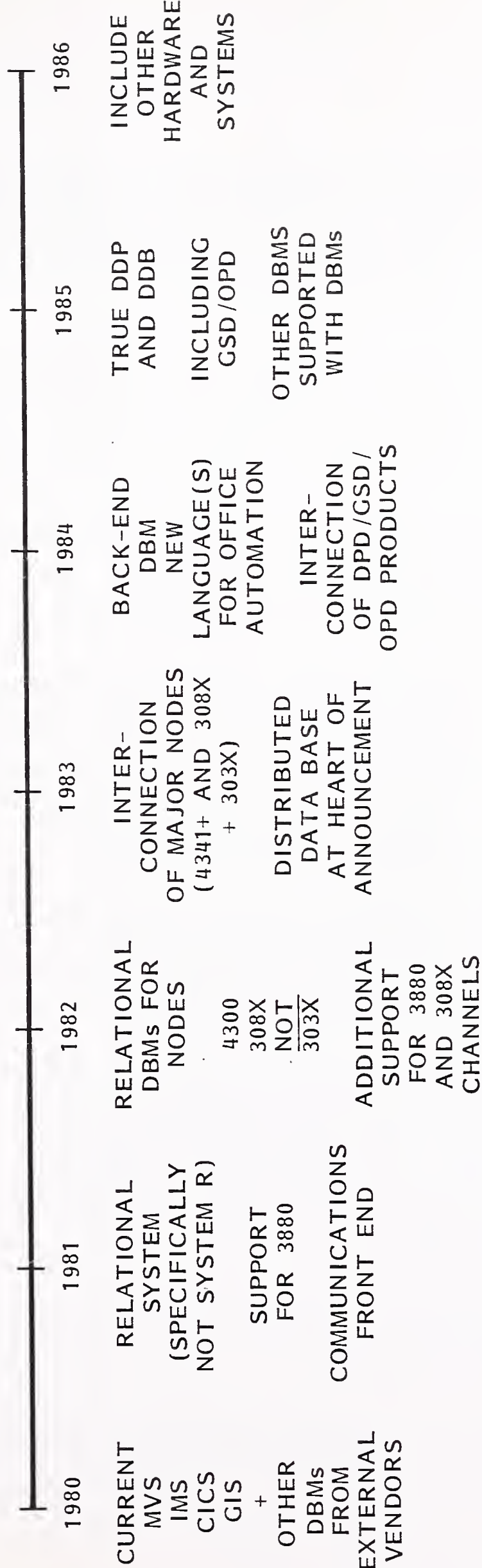
- It is INPUT's opinion that IBM will support a version of the "coexistence model" mentioned previously. This opinion does not imply that IBM necessarily wants to support this model; it may simply be a question of being forced to support all major data models. It will be accomplished through integration of additional models with existing systems.
- INPUT believes that the bridge problem can be solved, and that IBM will do an acceptable job of solving it. However, the performance problems will not necessarily be alleviated by distributed processing on backend DBMs. The ratios presented earlier defy hardware solutions alone, and it is INPUT's belief that IBM will not make major structural changes to its basic software support plan.

C. PROJECTED ANNOUNCEMENT DATES FOR NEW TECHNOLOGY

- Ideally, IBM would prefer to continue its conservative DBMS approach, as shown in Exhibit IV-2. This approach has the following time schedule:
 - In 1981, IBM will announce a relational system for large host systems. In addition, certain data base functions will be distributed to the 3880. Last but not least, it will announce a new communications front end. (Predicting the replacement of the 3705 is perhaps an example of what should be done rather than what IBM will do. However, INPUT has predicted this for so long that it does not wish to miss the actual announcement.)

EXHIBIT IV-2

IBM'S PREFERRED DBMS TIMING



- In 1982, IBM will announce a relational DBMS for the nodes. This system will be available on 4300 series and 308X series, but not on 303X. Additional data base support for the 3880 and 308X channels will also be announced.
 - In 1983, interconnection of major nodes and support of distributed data base will be announced. The 303X will be included in this support (along with the 4300 and 308X); but only for access to IMS data bases.
 - In 1984, a backend DBM will be announced along with one or more new nonprocedural language(s) for office automation. In addition, the interconnection of DPD/GSD/OPD products will be supported.
 - In 1985, DBMSs will be extended to include GSD and OPD products. This will be done with DBMs that support other data base and information management systems (including the network model) and will have image retrieval capability. At this point DBMSs become true information resource managers.
 - In 1986, the network and DBMSs will be extended to include competitive hardware and DBMS systems. This is necessary because networks will become interconnected.
- o It is INPUT's belief that IBM has a good chance of maintaining this schedule. However, a great deal depends upon how it supports current products such as the 3880. It is possible that the 3880 could be supported at a level where it could qualify as a true DBM. Thus a backend DBM could appear two years early (1982).
 - o In addition, it is possible that the network data model could be supported two years early (1983).
 - o Under any circumstances, the general schedule will be to concentrate on large customers during the early 1980s using an SNA type of approach to control the

amount of processing that can be distributed. The mid-1980s will see true distributed processing and data bases. At this point, IBM will be positioned to integrate office automation with data processing systems.

